DETAILED ACTION

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 01/08/2009 has been entered. Upon entering amendment, claims 1, 2 and 7 have been amended; claim objections have been withdrawn.

Response to Arguments

2. Applicant's arguments filed 01/08/2009 have been fully considered but they are not persuasive for reasons discussed below.

3. Applicant argues that Shirato does not disclose modulating the PWM signal according to at least one of the voltage supply and current supply and the contacting voltage which is sufficient to close the contact of the electromagnetic relay. The Examiner respectfully disagrees because Shirato clearly discloses in col. 11, lines 21-32 that modulating the PWM signal according to the voltage supply such that the "movable time" long enough, i.e., a logical level of "Hi", to supply the rated current to the relay coil RL1 under the rated voltage reaches its peak within the movable time, so that the relay coil RL1 moves and attracts the movable iron piece 15 (emphasis added).

4. Applicant also argues that Shirato does not disclose modulating the PWM signal according to at least one of the voltage supply and current supply and the maintaining

voltage which is sufficient to maintain closure of the contact. The Examiner respectfully disagrees because Shirato clearly discloses in col. 11, lines 33-56 that modulating the PWM signal according to the voltage supply such that the transistor Q5 alternating switches between the on-state and the off-state, i.e., A/B slots, to keep the movable iron piece 15 to be attached to the iron core 16. Additionally, Shirato discloses in col. 12, lines 28-32 and col. 13, lines 25-43 that the controller 31 supplies the base of transistor Q5 with the pulse signal in which the logical level is periodically set to "Hi" for a time period corresponding to the movable time in place of the pulse signal in which the logical level is alternate signal; thus the movable iron piece 15 can attach to the iron core 16 more firmly than when the holding current is supplied to the relay coil. Therefore, the movable iron piece 15 can be avoided from being separated from the relay coil RL1 due to the voltage drop of the commercial power source.

5. Applicant further argues that Glidden fails to disclose modulate the PWM signal according to at least one of the voltage supply and current supply and the contacting voltage which is sufficient to close the at least one contact of the relay and modulating the PWM signal according to at least one of the voltage supply and current supply and the maintaining voltage which is sufficient to maintain closure of the at least one contact. It was never the Examiner's position that Glidden discloses the above limitations. Rather, it is the Examiner's position that Shirato discloses the above limitations.

6. Similar arguments apply to claims 2 and 7.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 1-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shirato (US 6,518,764, “Shirato”) in view of Glidden et al. (US 6,493,204, “Glidden”).

9. **Regarding claim 1**, Shirato discloses relay driving apparatus, the apparatus (fig. 6) comprising: a control unit (31) configured to control the electromagnetic relay (15, 16), wherein the control unit generates a pulse-width modulation (PWM) signal (S80) according to a voltage supply; at least one contact (SW) controlled by the control unit, wherein the control unit is configured to control the at least one contact according to the voltage supply (col. 11, lines 21-40), the control unit inherently has a pulse duration modulation (PWM) to provide the PWM signal (S80) for supplying a contact voltage (“movable time” in fig. 7A) and a maintaining voltage ("A/B" slots in fig. 7A), wherein the PWM is configured to modulate the PWM signal according to the voltage supply and the contacting voltage which is sufficient to close the at least one contact of the electromagnetic relay (col. 11, lines 21-32), wherein the PWM is configured to modulate the PWM signal according to the voltage supply and the maintaining voltage which is sufficient to maintain closure of the at least one contact (col. 11, lines 33-46), wherein the control unit is configured to provide the contacting voltage to the electromagnetic relay, the contacting voltage sufficient to close the at least one contact (col. 11, lines 21-

32), and wherein the control unit is configured to provide, according to the voltage supply, the maintaining voltage sufficient to maintain closure of the at least one contact (col. Col. 33-46). Shirato does not explicitly disclose the control unit having a calculator for changing a cyclic ratio value of the PWM for supplying the maintaining voltage. Shirato rather discloses the control unit configured to change a cyclic ratio value of the PWM for supplying the maintaining voltage (on/off in fig. 7A). Glidden discloses a control unit (microprocessor 35) generates a PWM voltage having a constant frequency and variable duty cycle and the frequency of the PWM voltage is selected to be compatible with the response time of a solenoid (40) (col. 5, line 64 - col. 6, line 19). It would have been obvious to one of ordinary skill in the art at the time of the invention was made to use a microprocessor since today they are cheap, small and easily available to be used as a circuit part to control the relay. Also since the microprocessor is able to conduct arithmetic operations, it reads on the calculator in the claim.

10. **Regarding claim 2**, Shirato discloses a control unit (31) for an electromagnetic relay coupled to a voltage source (terminal 7 couples to voltage source) comprising: the control unit inherently has a power supply-adapting module for adapting the power supply to the relay, the power supply-adapting module inherently has a pulse duration modulator (PWM) for supply a contacting voltage ("movable time" in fig. 7A) and a maintaining voltage ("A/B" slots in fig. 7A), the control unit is configured to control the power supply-adapting module, the control unit generates a pulse-width modulation (PWM) signal (S80) according to a voltage supply; at least one contact (15) controlled by the control unit; the control unit is configured to provide the contacting voltage

sufficient to close the contact of the relay and the maintaining voltage sufficient to maintain closure of the at least one contact (col. 11, lines 21-46), the PWM signal is modulated according to the voltage supply and the contacting voltage which is sufficient to close the at least one contact of the electromagnetic relay (col. 11, lines 21-32); the PWM signal is modulated according to the voltage supply and the maintaining voltage which is sufficient to maintain closure of the at least one contact (col. 11, lines 33-46). Shirato does not explicitly disclose the power supplying-adapting module having a calculator for changing a cyclic ratio value of the PWM for supplying the maintaining voltage. Shirato rather discloses the control unit configured to change a cyclic ratio value of the PWM for supplying the maintaining voltage (on/off in fig. 7A). Glidden discloses a control unit (microprocessor 35) generates a PWM voltage having a constant frequency and variable duty cycle and the frequency of the PWM voltage is selected to be compatible with the response time of a solenoid (40) (col. 5, line 64 - col. 6, line 19). It would have been obvious to one of ordinary skill in the art at the time of the invention was made to use a microprocessor since today they are cheap, small and easily available to be used as a circuit part to control the relay. Also since the microprocessor is able to conduct arithmetic operations, it reads on the calculator in the claim.

11. **Regarding claim 3**, Shirato's control unit inherently has a controller that control the duration of operation of the power supply-adapting module during closure of the contacts (col. 11, lines 21-32) ("movable time" duration).

12. **Regarding claims 4, 8 and 9**, Shirato discloses that the control unit comprising a module for detecting micro power cuts (col. 13, lines 25-43). Shirato discloses that the control unit monitors the output voltage of the transformer 1, and if it is detected that that output voltage of the transformer drops, the control unit supplies the base of the transistor (Q5) with the pulse signal in which the logical level is set to "Hi" for the time period corresponding to the movable time. Therefore, the movable iron piece 15 can be avoided from being separated from the relay coil due to the voltage drop of the commercial power source.

13. **Regarding claim 5**, an oscillator generating pulses is inherent in Shirato's control unit since Shirato's control unit generates the PWM signal to control a transistor (Q5), the oscillator generated pulses (PWM signal) provides the contacting voltage and the maintaining voltage. The control unit generates the contracting voltage such that the duration of the contacting voltage is long enough to move armature of the relay and stay in contact stage and also provides the maintaining voltage such that on/off the duration of the maintaining voltage are long enough to keep armature in contact (on state) (col. 11, lines 33-46).

14. **Regarding claim 6**, Shirato discloses the limitations as discussed above. Shirato does not explicitly disclose a memory configured to store characteristics of the relay. Glidden discloses PWM control of a solenoid wherein the microprocessor includes a memory to store instructions (col. 1, lines 38-54). Using computer control is well known in the art. Computer software improves functionality and enables the system to perform multiple tasks. It would have been obvious to one of ordinary skill in

the art at the time of the invention was made to modify Shirato's control unit and add a memory, such as taught by Glidden, in order to improve functionality and perform multiple tasks.

15. **Regarding claim 7**, Shirato discloses relay driving apparatus; the apparatus (fig. 6) comprising: a control-command unit (31) which inherently has a pulse duration modulator (PWM), the control-command unit controlling the PWM for supplying a contacting voltage ("movable time" in fig. 7A) and a maintaining voltage ("A/B" slots in fig. 7A), the control-command unit is programmable for modulating a power supply of at least one electromagnetic relay (15, 16), the control-command unit modulates the power supply according to a voltage supply and the contacting voltage which is sufficient to close a contact of the relay (col. 11, lines 21-32), the control-command unit modules the power supply according to the voltage supply and the maintaining voltage which is sufficient to maintain closure of the contact (col. 11, lines 33-46), and the control-command unit is configured to provide the contacting voltage sufficient to close the electromagnetic relay and the maintaining voltage sufficient to maintain the closure of the contact (col. 11, lines 21-46). Shirato does not explicitly disclose a calculator for changing a cyclic ratio value of the pulse duration modulator for supplying the maintaining voltage. Shirato rather discloses the control unit configured to change a cyclic ratio value of the pulse duration modulator for supplying the maintaining voltage (on/off in fig. 7A). Glidden discloses a control unit (microprocessor, 35) generates a PWM voltage having a constant frequency and variable duty cycle and the frequency of the PWM voltage is selected to be compatible with the response time of a solenoid (40)

(col. 5, line 64 – col. 6, line 19). It would have been obvious to one of ordinary skill in the art at the time of the invention was made to use a microprocessor since today they are cheap, small and easily available to be used as a circuit part to control the relay. Also, since a microprocessor is able to conduct arithmetic operations, it reads on the calculator in the claim.

Conclusion

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to TIEN MAI whose telephone number is 571-270-1277. The examiner can normally be reached on M-Th: 7:00-5:00.

17. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Elms can be reached on 571-272-1869. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

/Tien Mai/
Examiner, Art Unit 2836

/Danny Nguyen/
Primary Examiner, Art Unit 2836